

Recent Progress In Planetary Balloons

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Success of the first planetary balloon mission – VEGA Venus balloons in 1985 – demonstrated that balloon platforms can become an important element in the planetary exploration. On Venus, balloons may serve as the scientific platforms for the *in situ* atmospheric measurements and for study of atmospheric circulation. They can be used to drop imaging and deep sounding probes at sites of interest and to acquire and relay high-rate imaging data as well as for studying of the mesosphere of Venus. High-temperature balloon lifting a sample canister and the Venus Ascent Vehicle rocket from the surface of Venus is enabling element for any Venus surface sample return mission. On Mars, the robotic balloons (aerobots) can fill the gap in resolution/coverage between the orbiters and rovers in high-resolution radar, visible, infrared, thermal, magnetic, and neutron mapping; they can be used for deployment of network of surface stations. On Titan, powered airships can perform long duration low-altitude global flight for high-resolution surface mapping and remote sensing, *in situ* atmospheric measurements, deployment of instrument packages for *in situ* surface studies. Aerobots can also be used for long-duration atmospheric studies of the outer planets.

In the last 15 years several balloon mission concepts has been proposed for Mars and Venus, one of them – Russian-French Mars Aerostat – was extensively developed in 1988-1995. It became clear that a number of critical technologies yet needed to be developed prior to commit a costly space mission. In recent years significant progress has been made in two critical fields: aerial deployment and inflation of thin-film balloons which is specifically planetary application, and in development of envelope design, which was driven primarily by Earth's stratospheric applications. The paper describes requirements, some of proposed concepts, critical elements and trade-offs in planetary balloon missions and current results of some of JPL balloon programs.